

Introduction: The size and complexity of the CMS detector¹ makes the Data Quality Monitoring (DQM²) system very challenging. Given the high granularity of the CMS sub-detectors, several approaches and tools have been developed to monitor the detector performance closely. We describe here the “History DQM”, a tool allowing the detector performance monitoring over time.

History DQM takes care of the extraction and visualisation of the summary information obtained from the run-based DQM histograms. The flexible and compact way of visualising the stored information proved to be useful to assess the data quality during the Cosmic Data taking of CMS in Autumn of 2008.

Architecture and design of the History DQM tool:

The History DQM consists of two steps :

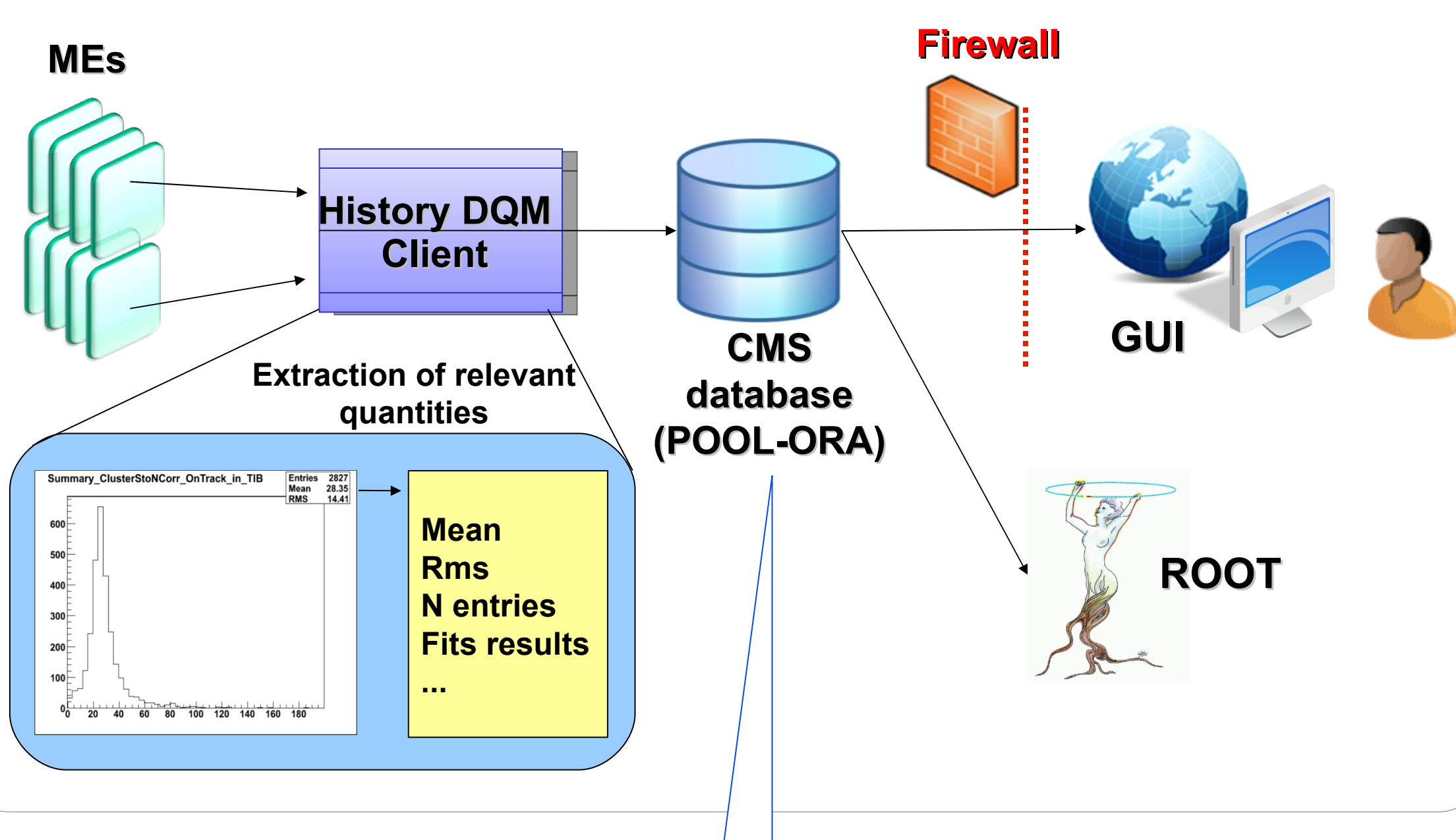
• Extraction and storage of the relevant information in the condition DB:

For each histogram corresponding to a monitored quantity the derived summary values are extracted and stored in the CMS database. The list of monitoring quantities is flexible and adapted to every DQM task.

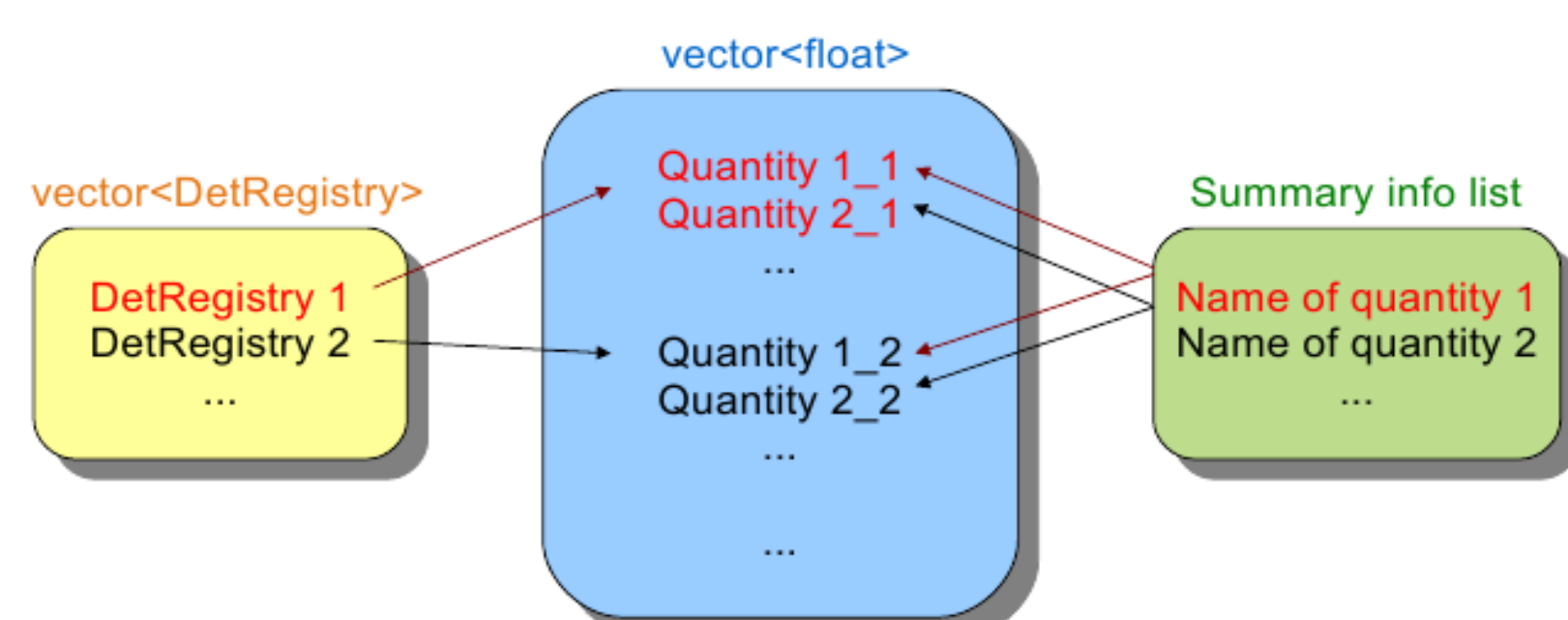
• Creation and visualisation of the trend charts:

Two complementary approaches have been developed for the access of summary information.

1. A Root based approach: intended for experts to be able to perform detailed analyses
2. A web service: intended for prompt feedback.

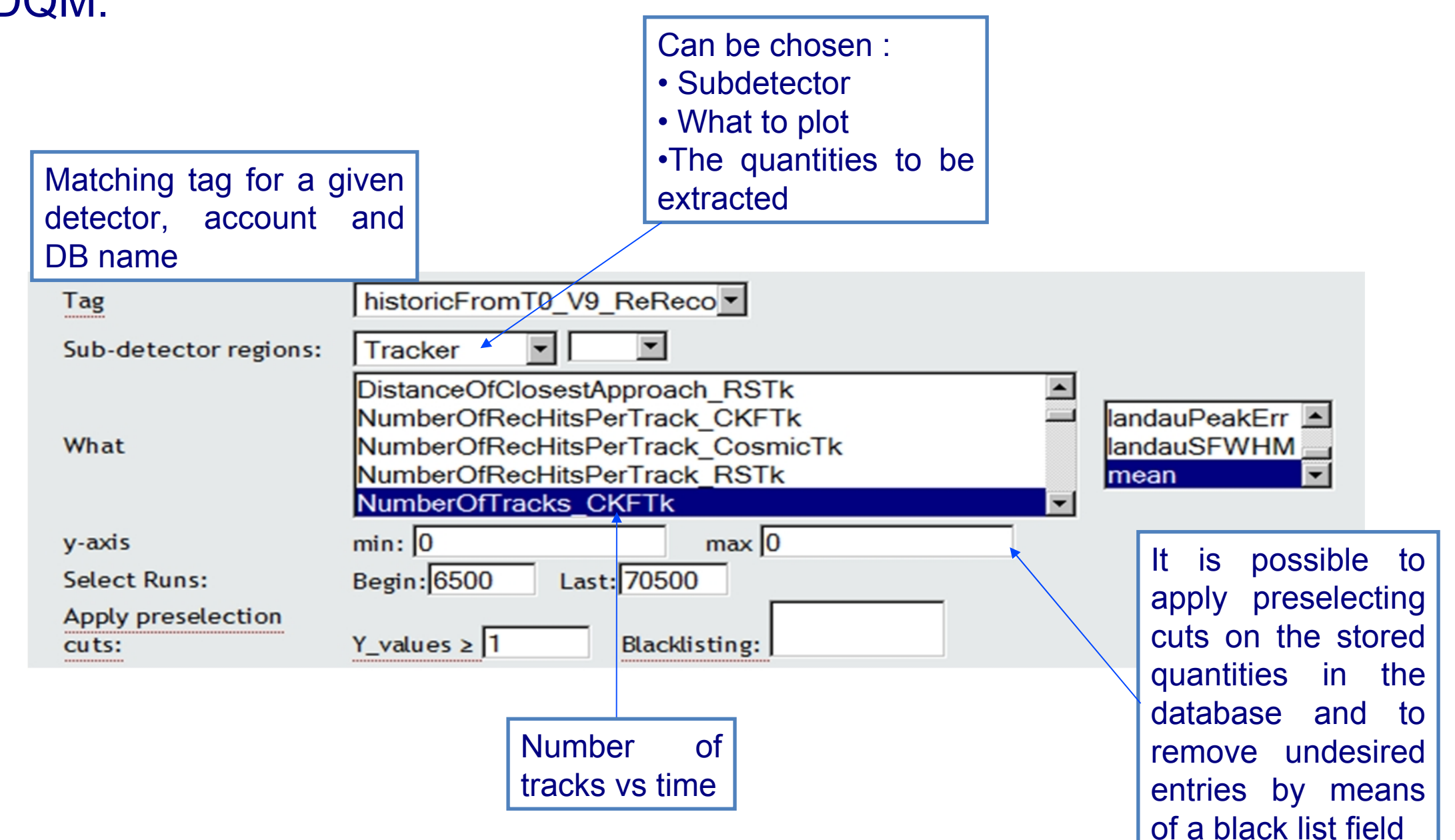


Database container structure: The interaction of the History DQM with the CMS database is based on the POOL-ORA technology³, already adopted in the CMS offline software⁴ to access the calibration data. This technology is C++ oriented in the definition of the database table and schemas.

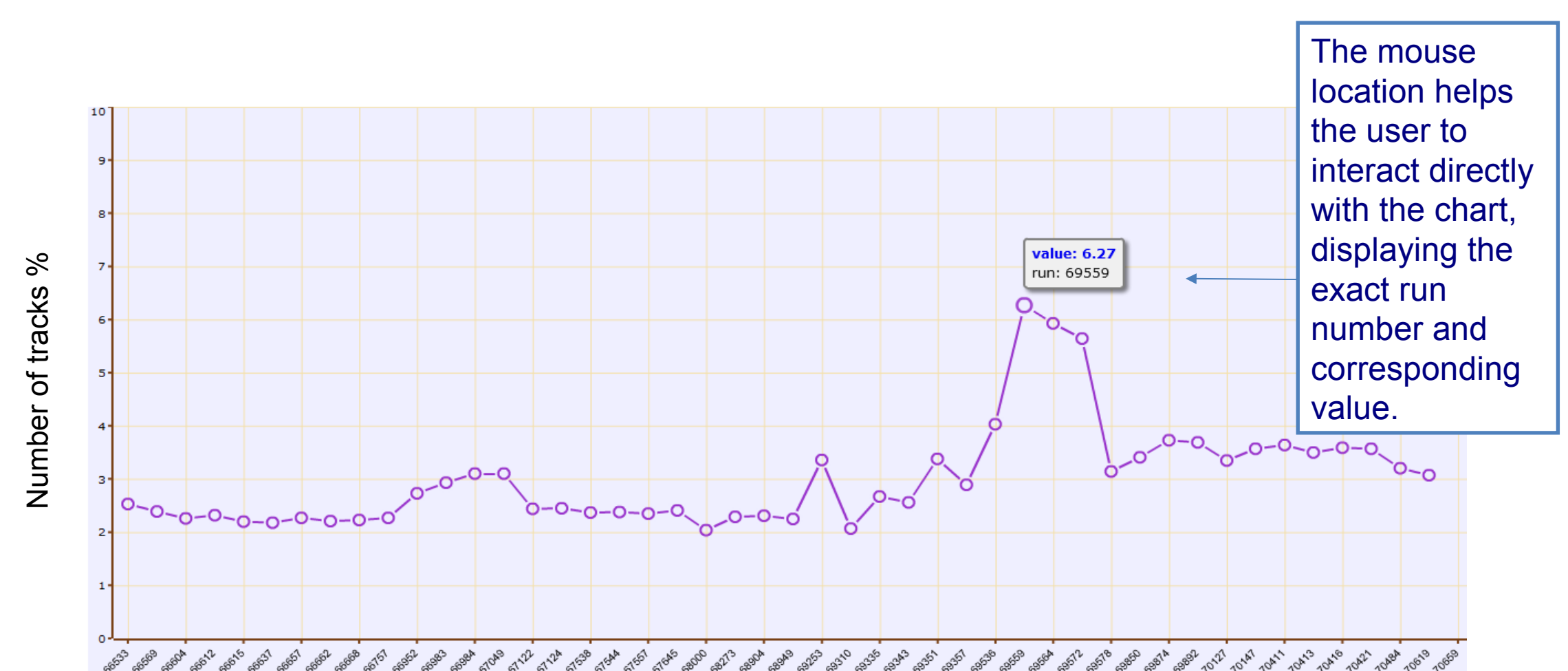


The database schema has been designed to accept and store a configurable number of summary information for a configurable and dynamic set of detector elements. This approach allows to store data at different granularity levels, and guarantees the backward compatibility in case of an extension of the list of monitored quantities.

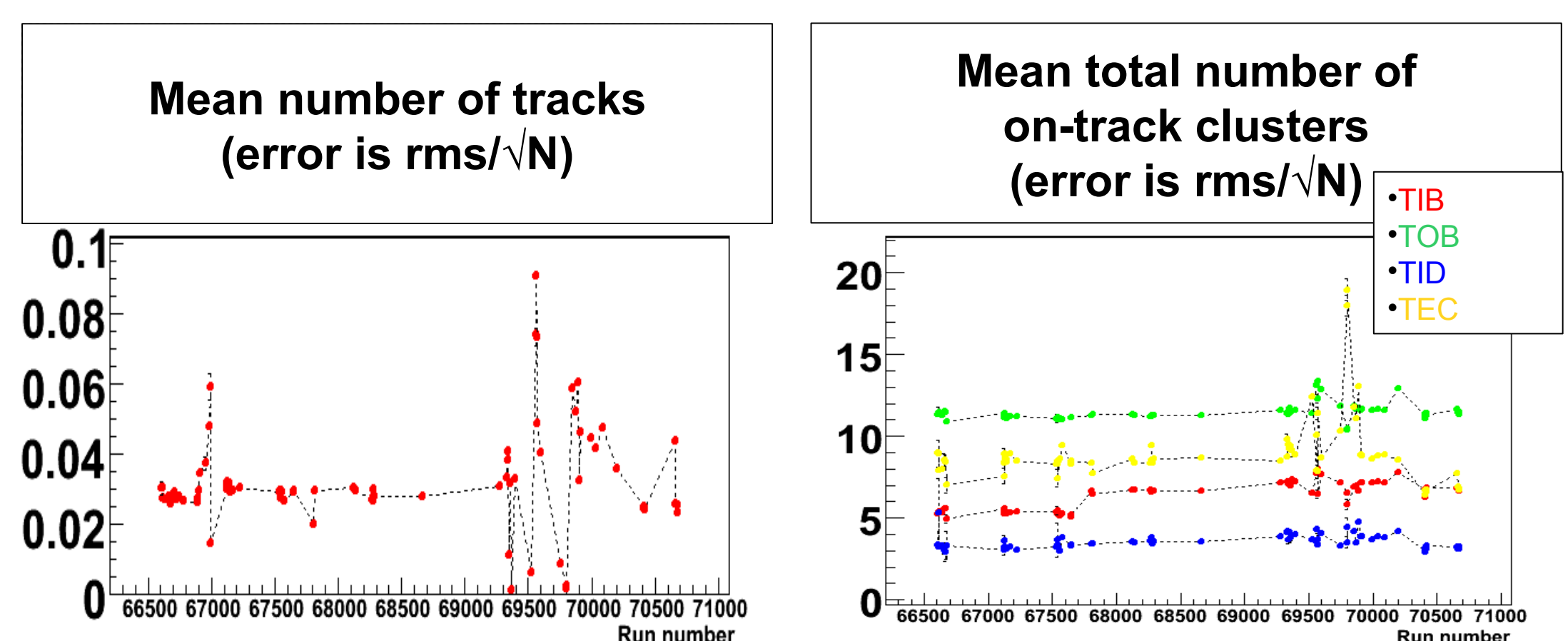
History Data Quality Monitoring service: allows the inspection over time of the calibration data stored in the database. A GUI provides access to the summary quantities extracted from the DQM.



Trend plots: example of trend chart created with the monitoring service for the mean number of tracks vs time.



Cosmic Data taking preliminary results: The Tracker detector has been included in the CMS data taking period with cosmic ray trigger in autumn 2008. Data were recorded both with and without 3.8 T magnetic field, for a total of 6 million tracks detected in the CMS silicon strip tracker.



Several analyses were performed to tag the (good/bad) status of the registered runs.

The Root access allowed to correlate the stored information in the database and to characterize the properties of the runs deviating from the reference.

References:

- [1] CMS Collaboration, 1994, CERN/LHCC 94-38, “Technical proposal” (Geneva, Switzerland)
- [2] C. Lenidopoulos, E. Meschi, I. Segoni, G. Eulisse, D. Tsirigkas, Physics and Data Quality Monitoring at CMS, CHEP06, Mumbai, India, February 2006
- [3] Pool Persistency Framework for the LHC New Developments and CMS Applications, Z.Xie et al. Proc. “Frontier Science 2005: New Frontiers in Sub nuclear Physics, September 12- 17, 2005 Milan, Italy”
- [4] Analysis environments for CMS, C.D. Jones et al. J. Phys.: Conf. 2008 Ser. 119 032027